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Observations on the Time of Eruption, the Growth Rate and the Effects of Cortisone on the Incisors in the Golden Hamster

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OBSERVATIONS ON THE TIME OF ERUPTION, THE GROWTH RATE AND THE EFFECTS OF CORTISONE ON THE INCISORS IN THE GOLDEN HAMSTER

by

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LIFE

Sigurd Carl Sandzén, Jr. was born on August 8, 1932, in New Rochelle, New York.

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INTRODUCTION

In working with cortisone, investigators have observed that it has an accelerating effect on the time of eruption of the incisors in the albino rat (Dorn and Leroy '55). Since observations on this point had apparently never been made on the hamster, a relatively new and widely used laboratory animal, we were interested in determining the effects of cortisone on the time of eruption and the growth rate of the incisors in this animal.

Our study was divided into two parts; (1) we wished to ascertain by actual measurement the normal rate of growth and attrition of adult hamster incisors, in order to confirm and supplement prevailing information (Keyes and Dale '44), and to determine the rate of growth and attrition following the administration of varying doses of cortisone; (2) we wanted to determine the exact time of eruption of the incisors, the degree of development at the time of birth and the effect of cortisone on the time of eruption.

In 1839, Waterhouse published an anatomical description of the skull of Cricetus auratus which was one of the first accounts of the golden Syrian hamster. In 1870, Günther published an account of the hamster Cricetus nigricans, then found in Bulgaria.

In 1930, in an eight foot burrow near Aleppo, Syria, Mr. B. Aharoni, ('32) unearthed an adult female hamster with a litter of twelve young. Four months

later, in August of the same year, the Hebrew University, in Jerusalem, where Mr. Aharoni was affiliated with the zoology department, boasted of the first litter born in captivity (Peczenik '42).

Two pairs of adult hamsters were given to Professor Hindle of the University of Glasgow by Dr. S. Adler in 1931, and in 1938, he shipped two colonies of hamsters to the United States, (Adler and Theodor '31). The Public Health Service in Carville, Louisiana received one colony, while the other went to Western Reserve University, Cleveland, Ohio. All of the hamsters in the United States today are believed to be the direct descendants of these two original colonies.

REVIEW OF LITERATURE

Normal growth rate of adult hamster incisors-

Keyes and Dale ('44) established a growth rate of 2.5 ± 0.5 millimeters per week for maxillary incisors, and 4.0 ± 0.7 millimeters per week for mandibulars. No sex difference was observed.

Extent of dentition in the post partum hamster pup-

Investigators have made contradictory statements concerning the extent of development of the dentition in the newborn hamster. Keyes and Dale ('44) state: "Intra-oral eruption begins very soon after birth and extends over a period of approximately 40-45 days. The incisors are the first to appear. They usually erupt within twenty-four hours after birth and attain occlusion within one day." Sheehan and Bruner ('45), on the other hand, state that the incisors have already erupted at the time of birth. Bond ('45) agrees with the observations of Sheehan and Bruner when she says, "Hamster teeth are present at birth....". ('Teeth' in the latter quote, obviously refers to the incisors.) None of these investigators mention the exact time of eruption of the incisors, nor were any histological studies made.

The effects of cortisone on the time of eruption and on the rate of growth of rat incisors have been studied by several investigators. Modifications in the growth rate of incisors of cortisone treated young rats were reported by Leroy and Dorn ('51). In working with mature rats of both

sexes, Doma and Marsano ('54) measured the growth rate of the incisors and noted that with the administration of cortisone, there followed an acceleration in the rate of growth of the continuously growing incisors. The studies of Garren ('54), and of Doma and Leroy ('55) indicate that this hormone produces an acceleration in the growth rate as well as precocious eruption of these teeth. A review of the literature revealed no such work on the hamster.

Breeding-

The female is sexually mature at two months of age and according to Bruce and Hindle ('34) will breed through her eleventh month of life.

The time of mating is determined by following microscopically the four day vaginal estrous cycle, since ovulation is known to occur once every four days. An opaque sticky discharge, rich in epithelial cells, as observed by Peczenik ('42), coincides with the ruptured follicle stage. There is, however, one caution that must be observed in relying on this method. On the second day of the cycle, a smear, abundant in leucocytes is present, corresponding to metoestrous; this metoestrous discharge is complicated by the appearance of paired leaf-like masses of epithelial cells in the lower vagina and must not be mistaken for the ruptured follicle stage of the current cycle (Deanesly '38).

Bond ('45) maintains that it is possible to use the vaginal smear technique to determine the precise stage of the estrous cycle of the hamster contrary to the opinion of Deanesly ('38).

When the vaginal discharge indicates the ruptured follicle stage, the female is placed with the male. This is usually done on the evening of the third day of the cycle, using the day of the discharge as the first day of the

cycle. The pair is left together overnight though it is believed that copulation usually takes place within the first fifteen minutes (Ward '46). If there is difficulty in mating, the female according to Pecsenik ('42) may be given a gonadotrophic hormone, or an estrogen since he observed successful matings in previously sterile hamsters following the injection of chorionic gonadotrophin or stilbesterol.

After the birth of the litter, the "maternity ward" should have as little disturbance and as little light as possible. According to Doull and Megrail ('39) it should not be cleaned until after the litter is weaned.

It is important that the male not be caged with the female during pregnancy, or after the birth of the young, for during this period she may kill the male, her litter, or both, as a result of maternal viciousness. The young should not be weaned or separated from their mother until they are about three weeks of age. At this time, the sexes should be segregated (Laidlaw '39).

Structure and morphology of the hamster incisors-

The dentition of the adult Syrian hamster consists of twelve permanent molars and four continuously growing incisors (Keyes and Dale '44).

The incisors consist of two uppers or maxillaries and two lowers or mandibulars. The uppers are short, slightly curved, and measure from 2.5 to 3.5 millimeters in length. The lowers, in contrast, are long, more noticeably curved and measure from 5 to 7 millimeters in length. In the hamster, as in the rat, the actual length of the continuously growing incisors is determined by the balance between the processes of growth and attrition (Addison and Appleton '15). In these experiments, we have not attempted to separate the processes of growth and attrition, but have instead, considered these

processes as being essentially in balance.

MATERIALS AND PROCEDURE

Animals-

Our experiments were begun with a shipment of twelve Syrian hamsters, six males and six females, obtained from Abrams Small Stock Farm in Chicago, Illinois. The animals in this initial shipment, as were the others procured from the Albino Farm, Redbank, New Jersey and from the Lakeview Hamster Colony, Newfield, New Jersey, were sexually mature and approximately six months of age.

The Syrian hamster, requires only minimal care and no special diet (Hamilton and Hogan '44), and is therefore easily reared in the laboratory. We employed metal cages to thwart his destructive proclivities and provided wood shavings for nesting material.

Since the hamster likes to store his food (Bruce and Windle '34), dog food in pellet form was provided along with a supplementary diet of greens and some fruits. Fresh water was available at all times. Since hamsters in captivity have been found to be omnivorous, it is important to eliminate meat from the diet of the female, for it has been observed that if pregnant females received meat in the diet, especially liver, they frequently devour all or a part of their litter. The pregnant and puerperal hamsters were always handled with gloves as they were often found to be extremely vicious.

Materials-

Controls and experimentals were treated as nearly alike as possible. Each adult male and female, appropriately marked for identification, was placed in a glass desiccator with cotton moistened with ether. After the hamster was anesthetized, we made a shallow transverse mark at the gingival margin of each of the four incisors with an electric portable dentist's drill or a small triangular or flat "pen-knive" type jeweler's file. Then, taking a pair of hermaphrodite calipers, one leg pointed and the other leg terminating in a flat area, we placed the flat end at the tip of the tooth and the pointed on the previously marked transverse line. The calipers were then set and transferred to a millimeter steel rule calibrated in $\frac{1}{2}$ millimeters, or to a six inch steel rule calibrated in 1/100ths of an inch, which measurement was later converted into millimeters. Three to seven days later, we again measured the distance from the mark to the tip of the tooth. The discrepancy between the distances of the old marks from the occlusal surfaces and the new marks at the gingival margins from the occlusal surfaces, at the different times of measurement, provided the rate of growth and attrition of the tooth for this particular period. From these measurements the values for the growth rate per week were calculated (Table II).

Experimental animals received a specific uniform dose of cortisone, subcutaneously, once daily, using a tuberculin syringe and a No. 17 needle, until toxic effects contraindicated further injections or sufficient time had elapsed for adequate measurements. The average period of injections was about three weeks. Four dosages of cortisone, 0.5, 1.5, 3.0 and 4.5 mg., (Cortone Acetate 25 mg. per cc) in single daily injections were administered in males

and three dosages, 1.5, 3.0 and 4.5 mg., in females (Table I).

Fetal heads prepared for microscopic study were fixed in neutral formalin (10% formalin solution saturated with calcium carbonate) and decalcified for half an hour in an ionic bone decalcifier. They were then dehydrated and imbedded in paraffin. The heads were saggitally sectioned at eight micra, mounted on slides and stained with hematoxylin and eosin.

Statistically, our problem was to determine whether or not there was a significant difference between pairs of means (eg. control compared with experimental mean incisal growth rates). We employed the statistical tests of the standard error of the difference between two means and the "t" tests of significance to determine the size of the difference between two means that is unlikely to occur by chance.

FORMULAE:[1]

(1) $$SEd = \sqrt{\frac{Sd_1}{N_1} + \frac{Sd_2}{N_2}}$$

Because we dealt with small numbers, the above values for the SEd (standard error of the difference between two means) were multiplied by:

(2) $$\sqrt{\frac{1}{N_1} + \frac{1}{N_2}}$$

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[1] Mainland, D., 1952 - Elementary Medical Statistics

KEY:
- Sd_1 standard deviation of Group One
- Sd_2 standard deviation of Group Two
- N_1 number in Group One
- N_2 number in Group Two
- M_1 mean of Group One
- M_2 mean of Group Two
- X individual value of a group

$$(3) \qquad \text{"t"} = \frac{M_1 - M_2}{SEd}$$

Example-

From Table II, Part 1., we obtained the mean growth rate of the male control left mandibular incisor using eleven animals. By applying the formula $Sd = \sqrt{\frac{(X-M)^2}{N-1}}$ we determined the standard deviation. Therefore $Sd = \sqrt{\frac{1.18}{10}} = 0.34$. From Table II., Part 2., we obtained the mean growth rate of the left mandibular incisors for the 0.5 mg. cortisone injected experimental animals. With nine animals, using the same formula, we determined the standard deviation to be 0.42. The above determined values may be found in Table III. We then determined the standard error of the difference between two means between the above incisors of the two groups of animals by Formula 1:

$$SEd = \sqrt{\frac{0.1180}{11} + \frac{0.1787}{9}} = 0.1749$$

This result was multiplied by Formula 2, to correct as much as possible any error due to the small numbers of animals employed.

Therefore $0.1749 \times \sqrt{\frac{1}{11} + \frac{1}{9}} = 0.79$

Finally the value of "t" was determined by using Formula 3:

$\frac{2.80 - 2.30}{0.0787} = 7.37.$

In referring to Table IV in Mainland, it is noted that for a probability of 0.05 and of 18 degrees of freedom, the significant level of "t" is 2.10. Therefore, any value of a calculated "t" greater than 2.10 will show an even greater lack of probability that the two groups compared (in this case, the

rate of growth and attrition of the left mandibular incisors of the controls compared to that of the 0.5 milligram cortisone injected experimental incisors) are from the same population. With our calculation of 7.37, it is extremely unlikely that the two compared groups are from the same population.

RESULTS

The experiments were carried out in five series from the twentieth of April, 1956 through the twenty-sixth of July, 1958. All experimental animals were injected once daily with their respective dosages of cortisone. The actual increments in millimeters are shown in Table I and the mean growth rates per week in Table II of the Appendix. The blank spaces in these two tables indicate that a measurement was unobtainable. The cause, in a few instances, was a broken tooth, but for the most part, the mark was lost at the tip or occlusal surface of the tooth due to growth and attrition.

In measuring Series I, II and V, the steel ruler calibrated in $\frac{1}{2}$ millimeters was employed. For Series III and IV, measurements were made on a ruler calibrated in 1/100ths of an inch and then converted into millimeters.

Standard deviations were calculated from the mean weekly incisor growth rates of all controls and experimentals (Table II). Standard errors of the differences between means were determined by comparison of the mean growth rates per week of male control incisors with those male experimentals receiving single daily injections of 0.5, 1.5, 3.0 and 4.5 mg. of cortisone (Table V). A comparison was also made of the mean weekly growth rates of female control incisors with those female experimentals receiving single daily injections of 3.0 mg. of cortisone (Table VI). Finally, the comparison of

mean control male with mean control female growth rates per week was made (Table VII).

We then computed "t" tests of significance for the above standard errors of the means. Results are given in Table V through VII.

The values of the standard deviation and the mean growth rate for the incisors of the control males and for each experimental male may be seen in Figure I. The graph shown depicts the striking difference between the mean growth rates of the mandibulars of the experimentals injected with 0.5 and 1.5 mg. of cortisone daily, and those of the controls. Examination of the graph will also show that the incisors of experimentals receiving dosages of 3.0 and 4.5 mg. daily failed to show a significant growth response.

In order that the reader may better visualize the results, the mean values of the cumulative growth for the left and right incisors of both maxillaries and mandibulars were averaged and are presented graphically in Figures III and IV.

Figures II and V show graphically the mean growth rate and standard deviation for the control and experimental female incisors and the mean values of the cumulative growth of these incisors respectively. There is no significant difference in either case between the growth rates even though on cursory study of the graph shown in Figure V, it might be thought that there is a significant difference between the mandibular growth rate of the control and the 3.0 mg. daily injected animals. This however, is a false impression since a large standard deviation is shown in Figure II and in Table III which obviates any such seeming differences.

Estimation of time of fetal incisor eruption-

Eight females in which time of mating was observed[2] (10:05 PM on February 17, 1958) were sacrificed at the estimated time of normal parturition between 9:05 and 10:50 AM on the 5th of March, 1958. From four trial dated matings at the beginning of the experiment, we estimated the time of birth to be approximately 15 days and 10 hours after observed copulation. The elapsed time between copulation and the actual fertilization of the egg is thought to be about ten hours. Our calculation of the period of gestation in the hamster, though slightly less than the period of 15 days and 21 hours reported by Bond ('45), proved to be essentially correct, and we were able to secure some normally born fetuses for comparison, both grossly and histologically, with fetuses removed at different ages by cesarean section.

Four control fetuses that were born normally and six control fetuses obtained by cesarean section were studied microscopically; four normally born experimental fetuses, and eight fetuses obtained by cesarean section were also studied microscopically. All 96 fetuses were examined grossly under the dissecting microscope.

Three of the pregnant females received single daily injections of 3.0 mg. of cortisone for four days prior to the time of estimated parturition. In this way, we attempted to note the effects of this hormone on the time of eruption of the incisors in the young of cortisone treated mothers (See Table VIII).

In addition, we sacrificed four pregnant females at varying times prior to the estimated parturition date, one animal on each of the last four days of gestation, to determine the exact time of incisor eruption. Previous gross

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[2]Observed by Lakeview Hamster Colony.

observations by ourselves had indicated that the incisors have generally erupted at the time of birth.

Eruption time of fetal incisors-

On examination under the dissecting microscope, all incisors were found to be erupted (ruptured the gingival epithelium) both in the immediately post partum fetuses and also in those recovered by cesarean section just before the estimated time of birth. Under the circumstances of the experiment we were unable to observe any alteration in the time of eruption where the mother had received single daily injections of 3.0 mg. of cortisone during the final four days of gestation. Gingival protrusions of the incisors in fetal hamsters were noted at 13 days and 20 hours post insemination in fetuses recovered by cesarean section but none of the teeth had actually pierced the oral epithelium.

Microscopically, very early incisor development was noted in the fetuses sacrificed 11 days and 15.5 hours after insemination (Plate 1, Figure 6). However, 20.5 hours later, 12 days and 20 hours after insemination, both a well defined mandibular and maxillary incisor were noted, which however extended to a point still well under the oral epithelium (Plate 2, Figure 7). It is therefore evident from our observations that the greatest fetal development of the incisors in the hamster occurs during the last four days of gestation.

At 13 days and 20 hours after insemination, the incisors were immediately beneath a thin layer of oral mucosa (Plate 3, Figure 8) and at 14 days and 14 hours after insemination, only a very thin layer of mucosa covered the tips of these teeth (Plate 4, Figure 9).

All incisors of control and experimental animals examined immediately post

partum, or just previous to parturition, had definitely erupted; that is the tips had pierced the oral mucosa and projected into the oral cavity (Plates 5 and 6, Figures 10 and 11).

DISCUSSION

Growth rate of incisors-

Our measurements of the normal growth rate of adult male hamster incisors differ from those reported by Keyes and Dale ('44). Their reported measurements are: maxillary growth average per week 2.5±0.5 millimeters compared to our value of 2.04±0.38 millimeters and mandibular average of 4.0±0.7 millimeters, to our value of 2.34±0.41. Keyes and Dale ('44) employed ten hamsters in their experiments while our observations are based on fourteen.

One of our objectives was to determine if there was any significant difference in the growth rates between normal male and female incisors. We observed such a difference in the maxillaries between males and females but not in the mandibulars (Table VII).

Our most important finding was the significant difference in mandibular incisor growth rates between the experimentally treated males and the controls. Cortisone, where injected in dosages of 0.5 and 1.5 mg., produced a significant acceleration in the mandibulars only. As noted above this is in striking contrast to its effect in the rat where it produces acceleration in the mandibulars and maxillaries of both sexes. In daily dosages of 3.0 and 4.5 mg. we observed no significant acceleration of the normal growth rate (Figures I, III and IV). In fact further experiments may show that a dosage of 4.5 mg. has an inhibitory rather than a stimulatory effect on the growth rate.

Only the group consisting of 3.0 mg. cortisone injected females (six animals) was large enough to be compared statistically with the controls. The incisal growth rates of the female experimentals injected with 1.5 and 4.5 mg. of cortisone daily (Table III) could not be compared with those of the controls because too few animals were used in the experimental groups. More work in this area might yield results similar to those found in the male.

Eruption time of fetal incisors-

Our work substantiates the observations of Sheehan and Bruner ('45) who observed that the incisors have erupted at the time of birth. The presence of erupted incisors at such an early age in the hamster is extremely interesting though its significance has not been established. Erupted incisors at such an early age may enable the mother to transport her litter of pups quickly in the event of danger, merely by their grasping her nipples. Also, in consequence, the pups are able to eat solid food at a very early age, (about seven to ten days post partum), which would indicate survival value in the event of the mother's death. The latter interpretation may have significance in view of the observations of Keyes and Dale ('44) who state that the incisors attain occlusion within one day after eruption.

Our studies, both gross and microscopic, on fetuses whose mothers had been treated daily with a dosage of 3.0 mg. of cortisone for four days prior to parturition (Animals 2T, 3T and 4T, Table VIII) revealed no noticeable alteration in time of eruption of the incisors. It should be recalled that Domm and Leroy ('55) observed precocious eruption in young rats whose mothers had been injected with cortisone during the period of pregnancy. However, in their experiments treatment of the pregnant rat was carried on for a longer

period of time. Since our observations were based on a period of cortisone administration lasting only four days, and since they were not made at the critical time of eruption, we are unable to make a definite statement with respect to the time of eruption under the influence of cortisone when administered during pregnancy in the hamster.

The information concerning the effects of cortisone on tooth formation is limited, but its effects on bone is well known (Drill '54). Its antianabolic (catabolic) properties cause osteoporosis in bone and a generalized inhibition of protein synthesis.

Massler and Schour ('41) state that the effect of pituitary and thyroid hormones on the growth of the incisors may be explained by the concomitant effects of these hormones on the vascularity of the tissues surrounding these teeth. Cortisone may exert a similar influence on vascularity as indicated by the observations of Mar-Yohana ('57) in cortisone treated fetal and newborn rats.

SUMMARY

1. The normal mean growth rates of the incisors of the adult male and female hamster were determined.

2. Daily injections of cortisone in dosages of 0.5 and 1.5 mg. accelerated the growth rate of the mandibular incisors of adult males, whereas doses of 3.0 or 4.5 mg. did not show an accelerative effect. Cortisone in these dosages had no accelerative effect on the maxillary incisors.

3. Daily injections of 3.0 mg. of cortisone as were administered in adult males failed to accelerate the growth rate of maxillary or mandibular incisors in adult females.

4. All incisors of newborn hamsters observed in these experiments had erupted at the time of birth.

5. Our observations on pre-erupted incisors revealed a very rapid growth rate during the last four days of pregnancy.

6. Cortisone administered in daily dosages of 3.0 mg. in the pregnant hamster during the last four days of pregnancy had no noticeable effect on the eruption time of fetal incisors, though our observations were not critically timed to determine the precise period of eruption.

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APPENDIX I

TABLES

TABLE I

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES I. Measured in millimeters

a) Control Females

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 1 4/20-5/18					
	4	0.500	0.200	0.100	0.400
	3	0.750	0.600	0.900	1.000
	4	1.300	1.000	1.000	1.400
	3	0.450	0.900	0.725	0.825
	4	1.150	0.350	1.250	1.250
	3	0.950	0.825	0.850	1.000
	4	0.700	0.800	1.150	1.000
	3	0.525	0.600	0.600	0.850
TOTALS	28	6.325	5.275	6.575	7.725
NO. 2 4/20-5/25					
	4	1.250	1.400	0.900	1.300
	3	1.000	0.625	0.500	0.600
	4	1.000	1.250	0.700	1.400
	3	0.500	0.500	0.900	1.000
	4	1.000	1.000	0.750	1.100
	3	0.900	0.900	0.600	0.900
	4	0.850	1.100	0.500	1.000
	3	0.700	0.460	0.900	0.900
	5	1.200	1.100	1.000	1.200
	2	0.300	0.500	0.250	0.400
TOTALS	35	8.700	8.835	7.000	9.800

b) Cortisone Injected Females - 3.0 mg. daily

NO. 1 4/20-5/18					
	7	4.300	3.000	2.500	2.800
	4	1.400	1.500	0.800	1.100
	3	1.300	1.500	0.450	1.000
	4	1.900	2.600	1.100	1.600
	3	0.950	0.750	0.500	0.600
	5	2.350	2.150	1.500	1.650
	2	1.150	1.100	0.900	1.000
TOTALS	28	13.350	13.600	7.750	9.750

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES I. Measured in millimeters

b) Cortisone Injected Females - 3.0 mg. daily

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 2 4/20-5/18					
	7	4.300	4.350	2.000	1.800
	4	2.000	2.000	1.000	0.900
	3	0.600	0.400	0.400	0.500
	4	1.400	1.400	2.000	1.900
	3	1.250	1.400	0.900	0.900
	5	1.150	1.000	1.000	0.700
	2	0.300	0.300	0.125	0.550
TOTALS	28	11.000	10.850	7.425	7.250

SERIES II. Measured in millimeters

a) Control Males

NO. 1 6/1-6/21					
	3	1.100	1.250	1.100	0.900
	4	1.000	0.900	0.900	0.900
	3	1.000	1.200	1.650	1.150
	5	1.450	1.500	------	1.000
	5	1.275	1.150	1.500	1.350
TOTALS	20	5.825	6.000	5.150	5.300
NO. 2 6/1-6/21					
	3		4.000	1.600	1.700
	4		0.780	0.500	0.800
	3	tooth	0.400	1.600	1.200
	5	out	1.600	1.100	1.400
	5		------	1.300	1.100
TOTALS	20		6.780	6.100	6.200

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES II. Measured in millimeters

b) Cortisone Injected Males - 3.0 mg. daily

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 1 6/1-6/21					
	3	1.300	1.400	2.400	2.400
	4	1.100	-----	1.000	1.200
	3	0.930	1.400	1.500	1.500
	5	1.600	1.500	1.250	1.100
	5	1.500	1.500	0.350	0.600
TOTALS	20	6.430	5.800	6.500	6.800
NO. 2 6/1-6/11					
	3	1.000	1.200	1.250	1.400
	4	1.050	1.200	0.650	0.500
	3	1.250	0.800	0.500	0.400
TOTALS	10	3.300	3.200	2.400	2.300

SERIES III. Measured in inches

a) Control Males

NO. 1 7/19-8/27					
	5	-----	0.065	-----	0.070
	6		0.075	-----	0.065
	8	tooth	0.090	0.060	0.080
	3	out	0.090	-----	-----
	11		0.190	-----	-----
	6		0.060	0.045	-----
TOTALS	39	-----	0.570	0.105	0.215

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES III. Measured in inches

a) Control Males

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 2 7/19-8/27					
	5	0.090	0.050	0.065	0.055
	6	0.130	0.100	-----	0.065
	8	0.145	0.110	-----	0.050
	3	0.025	0.015	-----	0.030
	11	0.020	0.145	-----	0.100
	6	0.045	0.050	0.030	0.070
TOTALS	39	0.655	0.470	0.095	0.370
NO. 3 7/19-8/27					
	5	0.075	0.555	-----	0.050
	6	-----	0.055	-----	0.050
	8	0.040	-----	0.110	0.090
	3	0.040	-----	-----	0.010
	11	0.160	0.130	-----	0.110
	6	0.060	0.050	0.055	0.050
TOTALS	39	0.375	0.290	0.165	0.360
NO. 4 7/19-8/27					
	5	0.075	0.075	0.080	0.070
	6	0.090	0.100	-----	-----
	8	0.130	0.120	0.085	0.060
	3	0.020	0.030	0.020	0.100
	11	0.135	0.155	-----	-----
	6	0.075	0.060	0.030	0.060
TOTALS	39	0.525	0.540	0.215	0.200

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES III. Measured in inches

b) Cortisone Injected Males - 1.5 mg. daily

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 1 8/27-9/19	6	0.100	0.075	0.075	0.065
	8	0.155	0.165	0.075	0.075
	9	0.200	0.185	0.120	0.105
TOTALS	23	0.455	0.425	0.270	0.245
NO. 2 8/27-9/19	6	0.140	0.150	-----	0.050
	8	0.190	0.185	0.075	0.070
	9	0.180	0.135	-----	0.040
TOTALS	23	0.510	0.470	0.075	0.160

c) Cortisone Injected Males - 3.0 mg. daily

NO. 1 8/29-9/19					
	6	0.115	0.150	-----	0.070
	8	0.170	0.125	0.035	0.085
	9	0.120	0.105	0.075	0.065
TOTALS	23	0.405	0.380	0.110	0.220

d) Cortisone Injected Males - 4.5 mg. daily

NO. 1 8/27-9/10					
	6	tooth	tooth	0.060	tooth
	8	out	out	0.050	out
TOTALS	14	-----	-----	0.110	-----
NO. 2 8/27-9/9					
	6	tooth	0.160	0.080	0.065
	7	out	0.050	0.130	0.115
TOTALS	13		0.210	0.210	0.180

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES III. Measured in inches

e) Control Females

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 1 7/19-8/27					
	5	0.090	0.080	———	———
	6	———	———	———	———
	8	0.180	0.190	———	———
	3	0.035	0.020	———	———
	11	0.240	0.230	———	———
	6	0.095	0.090	0.045	0.030
TOTALS	39	0.640	0.610	0.045	0.030
NO. 2 7/19-8/27	5	0.030	0.040	———	0.040
	6	0.120	0.085	0.030	———
	8	0.130	0.255	0.090	0.070
	3	0.020	0.010	0.035	0.030
	11	0.115	0.090	0.035	———
	6	———	0.015	0.070	0.060
TOTALS	39	0.415	0.495	0.260	0.200
NO. 3 7/19-8/27					
	5	0.010	0.030	0.030	0.020
	6	0.100	0.120	———	———
	8	0.165	0.140	0.075	0.060
	3	0.010	0.010	0.020	0.020
	11	0.105	0.160	0.110	0.075
	6	0.075	0.070	0.050	0.020
TOTALS	39	0.465	0.530	0.285	0.195

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES III. Measured in inches

a) Control Females

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 4 7/19-8/27					
	5	------	0.060	0.050	0.070
	6	0.555	0.150	------	------
	8	0.100	0.150	------	------
	3	0.020	------	------	------
	11	0.065	0.035	0.010	0.030
	6	0.060	0.075	0.060	0.050
TOTALS	39	0.300	0.470	0.120	0.150

SERIES IV. Measured in inches

a) Control Males

NO. 1 9/12-10/16					
	7	0.080	0.075	0.080	------
	6	0.065	0.075	------	------
	7	0.055	0.065	------	------
	7	0.115	0.075	0.085	0.085
	7	0.065	0.075	0.070	0.070
TOTALS	34	0.380	0.365	0.235	0.155
NO. 2 9/12-10/16					
	7	0.120	0.100	0.100	0.090
	6	0.100	0.115	------	------
	7	0.100	0.100	0.060	------
	7	0.080	0.030	0.080	------
	7	0.090	0.050	0.080	0.085
TOTALS	34	0.490	0.395	0.320	0.175
NO. 3 9/12-10/16					
	7	0.150	0.090	0.100	0.080
	6	0.100	0.100	0.090	0.095

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES IV. Measured in inches

a) Control Males

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 3					
9/12-10/16					
	7	0.100	0.075	-----	0.080
	7	0.090	0.112	-----	0.075
	7	0.060	0.110	-----	0.080
TOTALS	34	0.500	0.487	0.190	0.410
NO. 4					
9/12-10/16	7	0.150	0.160	-----	-----
	6	0.095	0.130	-----	-----
	7	0.095	0.110	-----	-----
	7	0.115	0.130	0.090	0.080
	7	0.055	0.180	-----	0.090
TOTALS	34	0.510	0.710	0.090	0.170

b) Cortisone Injected Males - 0.5 mg. daily

NO. 1					
9/21-10/12					
	7	0.140	0.130	-----	0.120
	7	0.065	0.065	0.030	0.045
	7	0.090	0.090	0.080	0.090
TOTALS	21	0.295	0.285	0.110	0.255
NO. 2					
9/21-10/12					
	7	0.160	-----	-----	0.115
	7	0.095	0.150	0.065	0.070
	7	0.120	0.115	0.095	0.070
TOTALS	21	0.375	0.265	0.160	0.255

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES IV. Measured in inches

b) Cortisone Injected Males - 0.5 mg. daily

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 3 9/21-10/12					
	7	0.085	0.110	0.070	0.080
	7	-----	-----	0.070	0.070
	7	0.100	0.085	0.090	0.075
TOTALS	21	0.185	0.195	0.230	0.225
NO. 4 9/21-10/12	7	0.150	0.100	0.075	0.105
	7	0.110	0.115	0.080	0.055
	7	0.150	0.080	0.105	0.100
TOTALS	21	0.410	0.295	0.260	0.260
NO. 5 9/21-10/12					
	7	0.230	0.220	0.105	-----
	7	0.070	0.085	0.065	0.055
	7	0.095	0.130	0.095	0.095
TOTALS	21	0.395	0.435	0.265	0.150

c) Cortisone Injected Males - 3.0 mg. daily

NO. 1 9/12-9/25					
	7	0.090	0.090	0.070	0.060
	6	0.080	0.070	0.045	0.040
TOTALS	13	0.170	0.160	0.115	0.100
NO. 2 9/12-9/19	7	0.060	0.050	0.040	0.050
NO. 3 9/12-9/19	7	-----	0.040	0.050	-----

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES IV. Measured in inches

c) Cortisone Injected Males - 3.0 mg. daily

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 4 9/19-9/25					
	7	0.100	0.090	0.075	0.055
	6	0.090	0.080	0.080	0.075
TOTALS	13	0.190	0.170	0.155	0.130

d) Cortisone Injected Males - 4.5 mg. daily

NO. 1 9/12-9/25					
	7	0.135	tooth	-----	-----
	6	0.105	out	0.075	0.070
TOTALS	13	0.235	-----	0.075	0.070
NO. 2 9/12-9/25					
	7	0.060	0.110	0.060	-----
	6	0.055	0.060	0.060	0.040
TOTALS	13	0.115	0.170	0.120	0.040
NO. 3 9/12-9/25					
	7	0.060	0.070	-----	0.030
	6	0.060	0.070	0.080	0.090
TOTALS	13	0.120	0.140	0.080	0.120
NO. 4 9/12-9/25					
	7	0.120	0.120	tooth	tooth
	6	0.060	0.062	out	out
TOTALS	13	0.180	0.182	-----	-----

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES IV. Measured in inches

e) Female Controls

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 1 9/21-10/12					
	7	0.090	0.095	-----	-----
	7	0.110	0.145	-----	-----
	7	0.110	0.105	0.030	0.050
TOTALS	21	0.310	0.345	0.030	0.050
NO. 2 9/21-10/12					
	7	0.050	0.040	-----	-----
	7	0.050	0.040	0.100	0.090
	7	0.060	0.050	0.060	0.095
TOTALS	21	0.160	0.130	0.160	0.185

f) Cortisone Injected Females - 3.0 mg. daily

NO. 1 9/21-10/12					
	7	0.190	0.125	-----	-----
	7	0.210	0.115	tooth	0.070
	7	0.120	-----	out	0.080
TOTALS	21	0.520	0.240	-----	0.150
NO. 2 9/21-10/12					
	7	0.060	0.060	-----	0.040
	7	0.050	0.062	0.020	0.050
	7	0.055	0.065	0.095	0.095
TOTALS	21	0.165	0.187	0.115	0.185
NO. 3 9/21-9/28					
	7	0.110	0.140	tooth	out

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES IV. Measured in inches

f) Cortisone Injected Females - 3.0 mg. daily

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 4 9/21-10/12					
	7	0.080	0.085	-----	-----
	7	0.080	0.130	-----	-----
	7	0.060	0.030	0.050	0.040
TOTALS	21	0.220	0.245	0.050	0.040

SERIES V. Measured in millimeters

a) Control Males

NO. 1 6/30-7/26	7	1.50	2.00	0.60	0.60
	4	1.10	1.20	1.30	1.70
	5	1.40	1.40	1.30	1.30
	5	1.90	2.00	1.80	1.60
	5	1.20	1.20	0.80	0.60
TOTALS	26	7.10	7.80	5.80	5.80
NO. 2 6/30-7/26					
	7	-----	2.70	2.40	2.00
	4	2.80	2.00	1.50	1.40
	5	1.40	2.10	2.00	1.60
	5	2.30	1.40	2.50	3.50
	5	1.20	1.20	0.80	0.60
TOTALS	26	7.70	9.40	9.20	9.10
NO. 3 6/30-7/26					
	7	2.60	3.60	1.80	1.30
	4	1.10	0.40	1.10	1.60
	5	1.50	2.90	2.10	1.40
	5	1.60	2.50	2.50	2.50
	5	1.70	1.60	0.70	0.60
TOTALS	26	8.50	11.00	8.20	7.40

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES V. Measured in millimeters

a) Control Males

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 4					
6/30-7/26	7	1.50	1.10	2.30	2.60
	4	1.30	1.00	1.50	1.50
	5	1.50	1.30	1.00	1.90
	5	2.60	2.40	1.80	2.10
	5	2.00	2.40	1.50	2.10
TOTALS	26	8.90	8.20	8.10	10.20

b) Cortisone Injected Males - 0.5 mg. daily

NO. 1					
6/30-7/26					
	7	2.60	4.10	----	----
	4	2.50	3.00	0.40	0.50
	5	2.50	2.90	1.50	2.40
	5	----	----	2.20	2.20
	5	1.70	2.70	2.30	----
TOTALS	26	9.30	12.70	6.40	5.10
NO. 2					
6/30-7/26					
	7	3.50	3.00	1.70	1.90
	4	1.80	2.10	1.60	1.90
	5	2.40	1.90	1.60	1.00
	5	1.00	1.60	1.50	1.50
	5	1.10	2.30	0.80	1.60
TOTALS	26	9.80	10.90	7.20	7.90
NO. 3					
6/30-7/26					
	7	3.60	----	2.30	2.30
	4	1.70	2.00	1.40	1.40
	5	2.20	3.60	1.00	1.10
	5	1.20	1.60	1.80	1.90
	5	1.40	2.20	1.10	1.00
TOTALS	26	10.10	9.40	7.60	7.70

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES V. Measured in Millimeters

b) Cortisone Injected Males - 0.5 mg. daily

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 4 6/30-7/26					
	7	2.80	3.50	2.30	2.00
	4	1.30	1.10	1.20	1.20
	5	1.80	2.60	1.00	1.10
	5	2.00	2.50	1.40	1.40
	5	1.50	2.10	1.40	1.40
TOTALS	26	9.40	11.80	7.30	7.10

c) Cortisone Injected Males - 1.5 mg daily

NO. 1 6/30-7/16					
	7	3.20	3.00	1.90	2.10
	4	----	----	----	----
	5		DEAD		
TOTALS	16	3.20	3.00	1.90	2.10
NO. 2 6/30-7/26					
	7	3.80	4.90	----	----
	4	1.40	2.10	0.90	0.90
	5	1.70	1.90	1.10	1.20
	5	3.00	1.50	1.60	1.60
	5	1.60	0.60	1.10	0.60
TOTALS	26	11.50	11.00	4.70	4.30
NO. 3 6/30-7/26					
	7	3.30	4.30	3.40	----
	4	1.10	1.10	0.80	0.60
	5	1.80	1.00	----	2.50
	5	3.30	2.90	0.50	1.80
	5	1.00	1.30	0.80	0.70
TOTALS	26	10.50	10.60	5.50	5.60

TABLE I (Continued)

INDIVIDUAL INCISOR GROWTH INCREMENTS

SERIES V. Measured in Millimeters

c) Cortisone Injected Males - 1.5 mg. daily

ANIMAL NO. AND DATES	DAYS OF GROWTH	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
NO. 4 6/30-7/26					
	?	----	----	----	----
	4	2.30	2.10	----	----
	5	2.00	1.40	0.50	1.00
	5	2.60	2.10	2.20	1.60
	5	1.70	0.90	1.10	2.00
TOTALS	26	8.60	6.50	3.80	4.60

TABLE II

MEAN INCISOR GROWTH RATES IN MILLIMETERS PER WEEK

SERIES AND ANIMALS	MANDIBULAR		MAXILLARY	
	LEFT	RIGHT	LEFT	RIGHT
1. Control Males				
II, No. 1	2.04	3.16	2.14	2.17
II, No. 2	----	2.10	2.40	1.86
III, No. 1	----	2.67	1.26	1.78
III, No. 2	2.99	2.13	1.60	1.69
III, No. 3	2.03	1.78	2.35	1.64
III, No. 4	2.38	2.49	1.73	1.60
IV, No. 1	1.99	1.91	1.99	1.97
IV, No. 2	2.04	2.06	2.03	2.22
IV, No. 3	2.61	2.54	2.60	2.14
IV, No. 4	2.67	----	2.29	2.15
V, No. 1	1.91	2.10	1.56	1.56
V, No. 2	----	2.69	2.61	2.67
V, No. 3	2.29	2.96	2.21	1.99
V, No. 4	2.39	2.23	2.18	2.74
MEAN	2.30	2.37	2.07	2.01
2. Cortisone Injected Males - 0.5 mg. daily				
IV, No. 1	2.50	2.41	1.40	2.16
IV, No. 2	3.18	3.37	2.03	2.16
IV, No. 3	2.35	2.48	1.95	1.90
IV, No. 4	3.55	2.50	2.20	2.20
IV, No. 5	3.34	3.68	2.24	1.90
V, No. 1	3.10	----	2.36	2.55
V, No. 2	2.64	2.93	1.94	2.13
V, No. 3	2.72	3.47	2.04	2.07
V, No. 4	2.53	3.18	1.97	1.91
MEAN	2.88	3.00	2.01	2.11
3. Cortisone Injected Males - 1.5 mg. daily				
III, No. 1	3.52	3.27	2.13	1.88
III, No. 2	3.93	3.63	1.67	1.25
V, No. 1	3.20	3.00	1.90	2.10
V, No. 2	3.09	2.96	1.73	1.58
V, No. 3	2.83	2.86	1.83	2.07
V, No. 4	3.17	2.39	1.77	2.15
MEAN	3.29	3.02	1.84	1.84

TABLE II (Continued)

MEAN INCISOR GROWTH RATES IN MILLIMETERS PER WEEK

SERIES AND ANIMALS	MANDIBULAR		MAXILLARY	
	LEFT	RIGHT	LEFT	RIGHT
4. Cortisone Injected Males - 3.0 mg. daily				
II, No. 1	2.25	2.54	2.28	2.38
II, No. 2	2.31	2.24	1.68	1.61
III, No. 1	3.13	2.93	1.09	1.37
IV, No. 1	2.33	2.19	1.57	1.71
IV, No. 2	1.53	1.27	1.01	----
IV, No. 3	----	1.01	1.27	1.27
IV, No. 4	2.60	2.33	2.62	1.78
MEAN	2.36	2.07	1.65	1.69
5. Cortisone Injected Males - 4.5 mg. daily				
III, No. 1	----	----	1.41	----
III, No. 2	----	2.85	2.85	2.49
IV, No. 1	2.21	----	2.22	2.07
IV, No. 2	1.57	2.32	1.64	1.19
IV, No. 3	1.64	1.92	2.36	1.64
IV, No. 4	2.45	2.49	----	----
MEAN	1.97	2.40	2.09	1.85
6. Female Controls				
I, No. 1	1.58	1.32	1.64	1.93
I, No. 2	1.74	1.77	1.40	1.95
III, No. 1	3.45	3.29	1.33	0.89
III, No. 2	2.24	2.53	1.37	1.60
III, No. 3	2.12	2.42	1.49	1.01
III, No. 4	1.60	2.31	0.98	1.21
IV, No. 1	2.62	2.92	0.76	1.27
IV, No. 2	1.35	1.10	2.03	2.35
MEAN	2.09	2.21	1.37	1.53

TABLE II (Continued)

MEAN INCISOR GROWTH RATES IN MILLIMETERS PER WEEK

7. Cortisone Injected Females - 1.5 mg. daily

SERIES AND ANIMALS	MANDIBULAR LEFT	MANDIBULAR RIGHT	MAXILLARY LEFT	MAXILLARY RIGHT
III, No. 1	----	1.78	1.42	1.53
III, No. 2	2.28	2.54	1.49	1.74
III, No. 3	3.39	2.31	1.83	2.06
MEAN	2.83	2.21	1.58	1.78

8. Cortisone Injected Females - 3.0 mg. daily

I, No. 1	3.34	3.40	1.94	2.44
I, No. 2	2.75	2.71	1.86	1.81
IV, No. 1	4.41	3.05	----	1.91
IV, No. 2	1.40	1.58	1.46	1.57
IV, No. 3	2.79	3.56	----	----
IV, No. 4	1.87	2.07	1.27	1.02
MEAN	2.76	2.73	1.63	1.75

9. Cortisone Injected Females - 4.5 mg. daily

III, No. 1	2.47	----	1.28	1.20
III, No. 2	1.42	2.31	1.42	1.14
MEAN	1.95	2.31	1.35	1.17

TABLE III

GROUP MEAN INCISOR GROWTH RATES AND STANDARD DEVIATIONS OF MALES IN MILLIMETERS PER WEEK

	MANDIBULAR		MAXILLARY	
	LEFT	RIGHT	LEFT	RIGHT
CONTROLS 0.0 mg. 14**	2.30 ± 0.34* 11	2.37 ± 0.42 13	2.07 ± 0.40 14	2.01 ± 0.37 14
EXPERIMENTAL 0.5 mg 9	2.88 ± 0.42 9	3.00 ± 0.46 8	2.01 ± 0.27 9	2.11 ± 0.20 9
EXPERIMENTAL 1.5 mg. 6	3.29 ± 0.38 6	3.02 ± 0.42 6	1.84 ± 0.16 6	1.84 ± 0.36 6
EXPERIMENTAL 3.0 mg. 7	2.36 ± 0.52 6	2.07 ± 0.69 7	1.65 ± 0.61 7	1.69 ± 0.39 6
EXPERIMENTAL 4.5 mg. 6	1.97 ± 0.43 4	2.40 ± 0.38 4	2.09 ± 0.56 5	1.85 ± 0.56 4

KEY:

* Sd.
** Number of animals used

TABLE IV

GROUP MEAN INCISOR GROWTH RATES WITH STANDARD DEVIATIONS FOR FEMALES IN MILLIMETERS PER WEEK

	MANDIBULAR		MAXILLARY	
	LEFT	RIGHT	LEFT	RIGHT
CONTROLS 0.0 mg.	2.09 ± 0.69*	2.21 ± 0.76	1.37 ± 0.39	1.53 ± 0.53
8**	8	8	8	8
EXPERIMENTAL 1.5 mg.	2.83 ± 0.79	2.21 ± 0.39	1.58 ± 0.22	1.78 ± 0.27
3	2	3	3	3
EXPERIMENTAL 3.0 mg.	2.76 ± 1.07	2.73 ± 0.77	1.63 ± 0.32	1.75 ± 0.52
6	6	6	4	5
EXPERIMENTAL 4.5 mg	1.95 ± 0.74	2.31 ± 0.0#	1.35 ± 0.10	1.17 ± 0.04
2	2	1	2	2

KEY:

* Sd.
** Number of animals used
\# Sd. could not be calculated since only one animal could be used

TABLE V

TEST OF SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEAN INCISOR GROWTH RATES OF CONTROL AND EXPERIMENTAL MALES

	MANDIBULAR		MAXILLARY	
	LEFT	RIGHT	LEFT	RIGHT
t(calc.)1	7.37	7.00	1.00	1.95
t(sig.)	2.10	2.09	2.08	2.08
N	18	19	21	21
t(calc.)2	10.39	6.42	3.72	1.99
t(sig.)	2.13	2.11	2.10	2.10
n	15	17	18	18
t(calc.)3	0.15	2.45	3.00	2.52
t(sig.)	2.18	2.13	2.13	2.15
n	12	15	15	14
t(calc.)4	2.39	0.38	1.02	0.40
t(sig.)	2.23	2.18	2.16	2.18
n	10	12	13	12

KEY:

t(calc.)1 The comparison between male controls and male experimentals receiving a 0.5 mg. daily injection of cortisone

t(calc.)2 The comparison between male controls and male experimentals receiving a 1.5 mg. daily injection of cortisone

t(calc.)3 The comparison between male controls and male experimentals receiving a 3.0 mg. daily injection of cortisone

t(calc.)4 The comparison between male controls and male experimentals receiving a 4.5 mg. daily injection of cortisone

t(sig.) Minimum value of 't' required for significance at the 0.05 level

n The number of degrees of freedom

TABLE VI

TEST OF SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEAN INCISOR GROWTH RATES OF CONTROL AND EXPERIMENTAL FEMALES

	MANDIBULAR		MAXILLARY	
	LEFT	RIGHT	LEFT	RIGHT
t(calc.)	1.40	2.31	2.01	1.31
t(sig.)	2.18	2.18	2.23	2.20
n	12	12	10	11

KEY:

t(calc.) The comparison between female controls and female experimentals receiving a 3.0 mg. daily injection of cortisone

t(sig.) Minimum value of 't' required for significance at the 0.05 level

n The number of degrees of freedom

TABLE VII

TEST OF SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEAN INCISOR GROWTH RATE OF MALE AND FEMALE CONTROLS

	MANDIBULAR		MAXILLARY	
	LEFT	RIGHT	LEFT	RIGHT
t(calc.)*	1.71	1.22	9.07	5.22
t(sig.)	2.15	2.12	2.12	2.12
n	14	16	16	16

KEY:

t(calc.)* The comparison between male and female controls

t(sig.) The minimum value required (of 't') for significance at the 0.05 level

n The number of degrees of freedom

TABLE VIII

OBSERVATIONS ON INCISORS OF FETUSES OF KNOWN GESTATION AGE

ANIMAL	MATING TIME	TIME OF BIRTH OR CESAREAN	GESTATION AGE	# IN LITTER	# BORN ALIVE	# REMOVED BY CESAREAN	# EXAMINED HISTOLOGICALLY	OBSERVATIONS ON ERUPTION GROSS	OBSERVATIONS ON ERUPTION MICRO
A	10:25 PM 1-24-58	1:30 PM 2-5-58	11 days 15.5 h	11	0	11	2 cesareans	no teeth observed.	small incisors noted.
B	10:26 PM 1-24-58	5:45 PM 2-6-58	12 days 20 h.	12	0	12	2 cesareans	no teeth observed.	well developed teeth beneath epithelium.
C	10:11 PM 1-24-58	6:15 PM 2-7-58	13 days 20 h.	10	0	10	2 cesareans	no teeth observed.	just beneath epithelium.
D	10:14 PM 1-24-58	12:01 PM 2-8-58	14 days 14 h.	13	0	13	2 cesareans	teeth evident beneath epithelium.	just beneath thin membrane
1	10:05 PM 2-17-58	9:05 AM 3-5-58	TERM	12	12	0	4 born	all teeth erupted.	all teeth erupted.
2T	10:05 PM 2-17-58	10:12 AM 3-5-58	TERM	11	1	10	4 cesareans	all teeth erupted.	all teeth erupted.
3T	10:05 PM 2-17-58	10:20 AM 3-5-58	TERM	15	6	9	4 born 2 cesareans	all teeth erupted.	all teeth erupted.
4T	10:05 PM 2-17-58	10:30 AM 3-5-58	TERM	13	0	13	2 cesareans	all teeth erupted.	all teeth erupted.

TABLE VIII (Continued)

OBSERVATIONS ON INCISORS OF FETUSES OF KNOWN GESTATION AGE

ANIMAL	MATING TIME	TIME OF BIRTH OR CESAREAN	GESTATION AGE	# IN LITTER	# BORN ALIVE	# REMOVED BY CESAREAN	# EXAMINED HISTOLOGICALLY	OBSERVATIONS ON ERUPTION GROSS	OBSERVATIONS ON ERUPTION MICRO
5	10:05 PM 2-17-58	10:35 AM 3-5-58	TERM	10	0	9	0	all teeth erupted.	all teeth erupted.
6	10:05 PM 2-17-58	10:40 AM 3-5-58	TERM	11	3	8	4 cesareans	all teeth erupted.	all teeth erupted.
7	10:05 PM 2-17-58	10:45 AM 3-5-58	TERM	12	0	12	0	all teeth erupted.	all teeth erupted.
8	10:05 PM 2-17-58	10:50 AM 3-5-58	TERM	12	0	12	2 cesareans	all teeth erupted.	all teeth erupted.

T - Animals treated with a single daily injection of 3.0 mg. of cortisone for four days prior to birth or cesarean section.

APPENDIX II

FIGURES AND PLATES

FIGURE 1

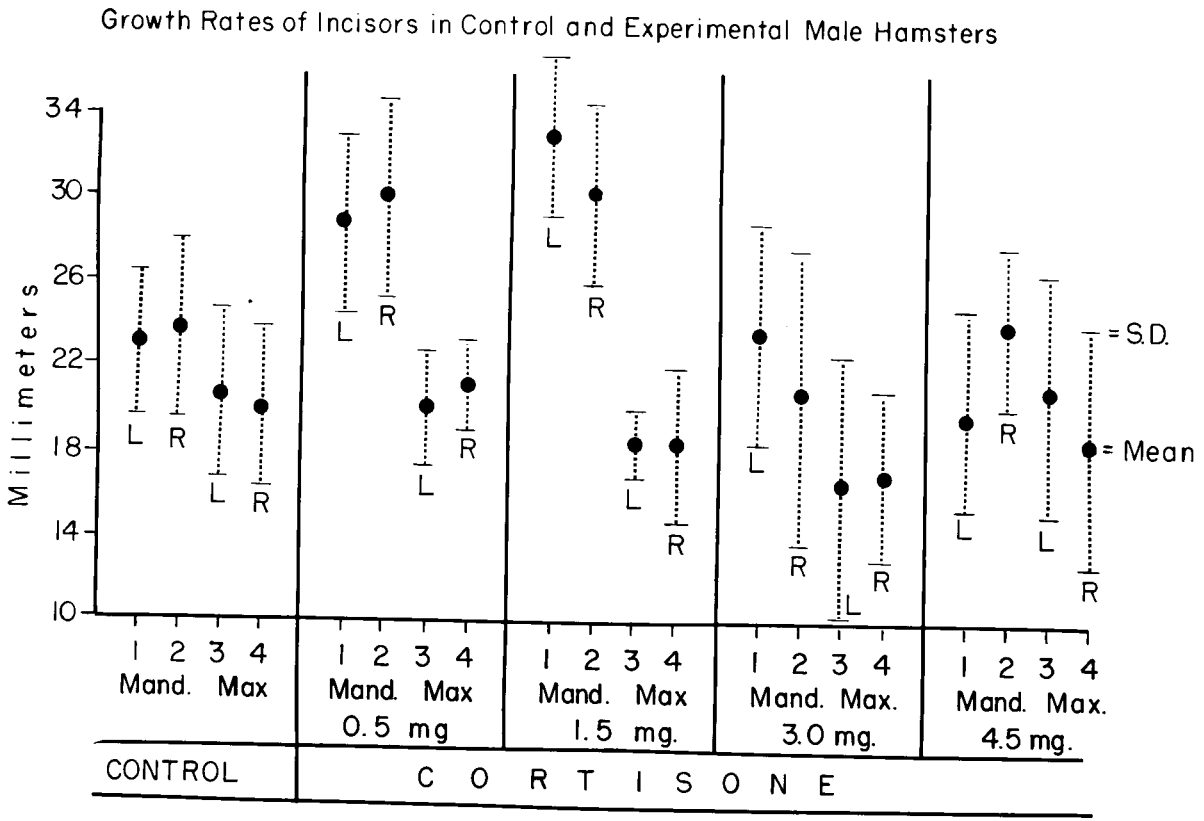

Growth Rates of Incisors in Control and Experimental Male Hamsters
Millimeters
34
30
26
22
18
14
10
L
R
= S.D.
= Mean
1 2 3 4
Mand. Max
0.5 mg
1.5 mg.
3.0 mg.
4.5 mg.
CONTROL
C O R T I S O N E

FIGURE 2

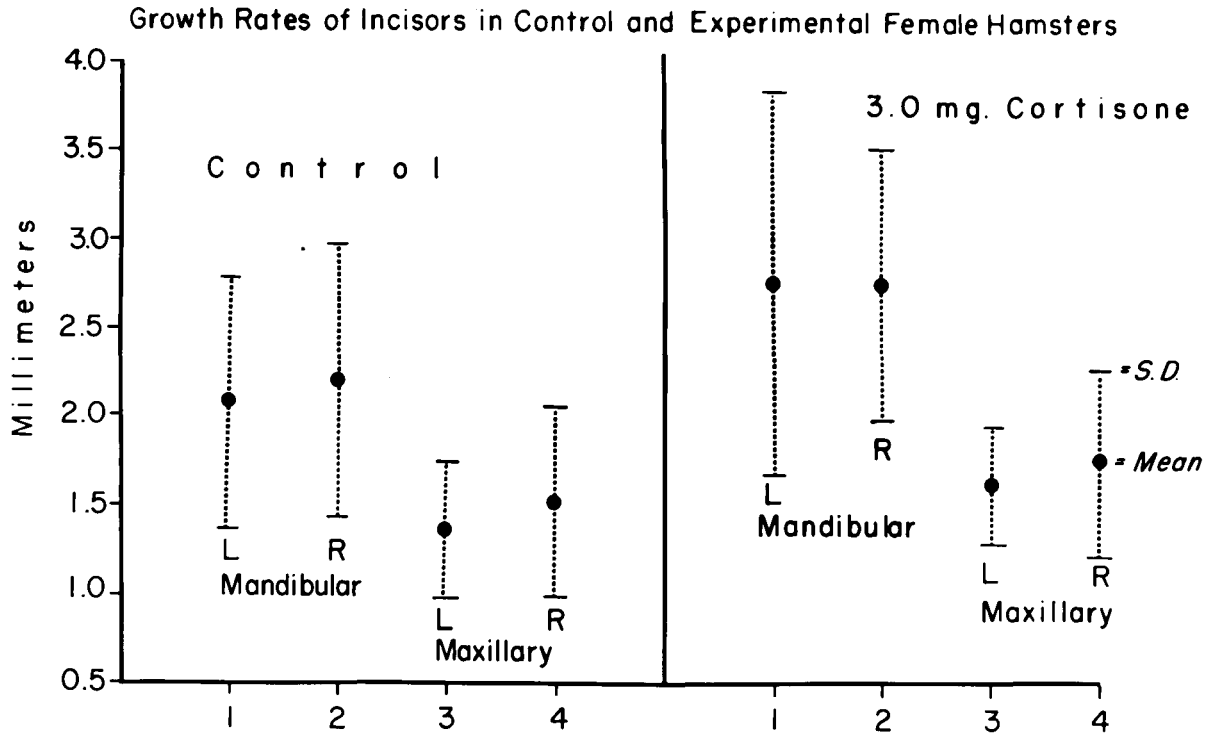

Growth Rates of Incisors in Control and Experimental Female Hamsters
Millimeters
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
Control
L
R
Mandibular
L
R
Maxillary
3.0 mg. Cortisone
L
R
Mandibular
L
R
Maxillary
= S.D.
= Mean
1
2
3
4
1
2
3
4

FIGURE 3

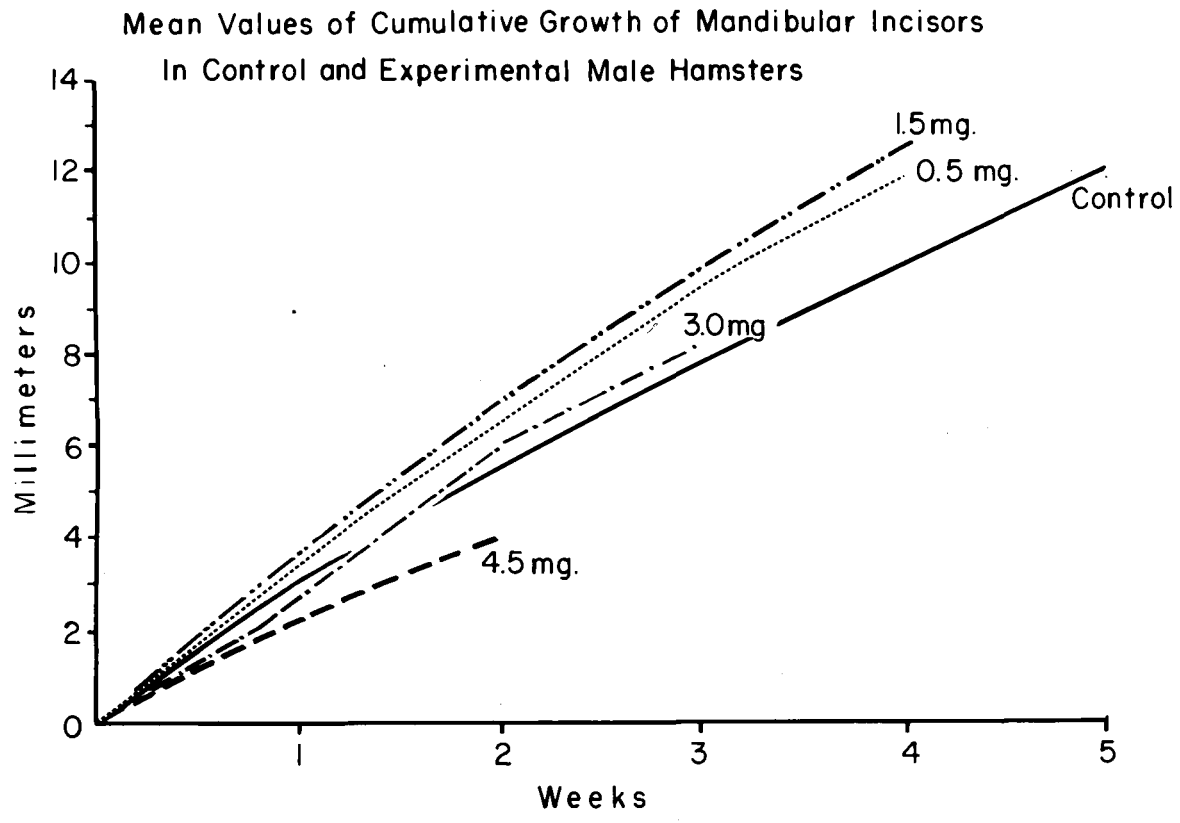

Mean Values of Cumulative Growth of Mandibular Incisors
In Control and Experimental Male Hamsters
Millimeters
0
2
4
6
8
10
12
14
1
2
3
4
5
Weeks
1.5mg.
0.5 mg.
Control
3.0mg
4.5mg.

FIGURE 4

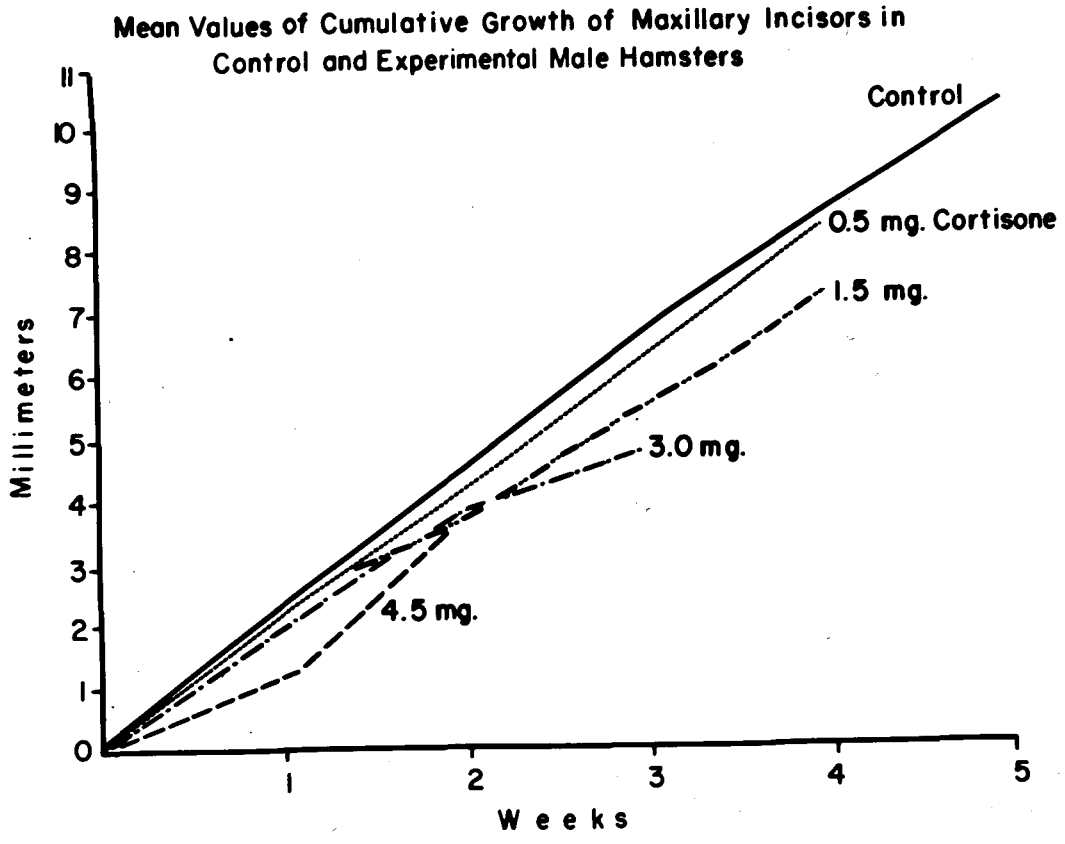

Mean Values of Cumulative Growth of Maxillary Incisors in
Control and Experimental Male Hamsters
Millimeters
0
1
2
3
4
5
6
7
8
9
10
11
Weeks
1
2
3
4
5
Control
0.5 mg. Cortisone
1.5 mg.
3.0 mg.
4.5 mg.

FIGURE 5

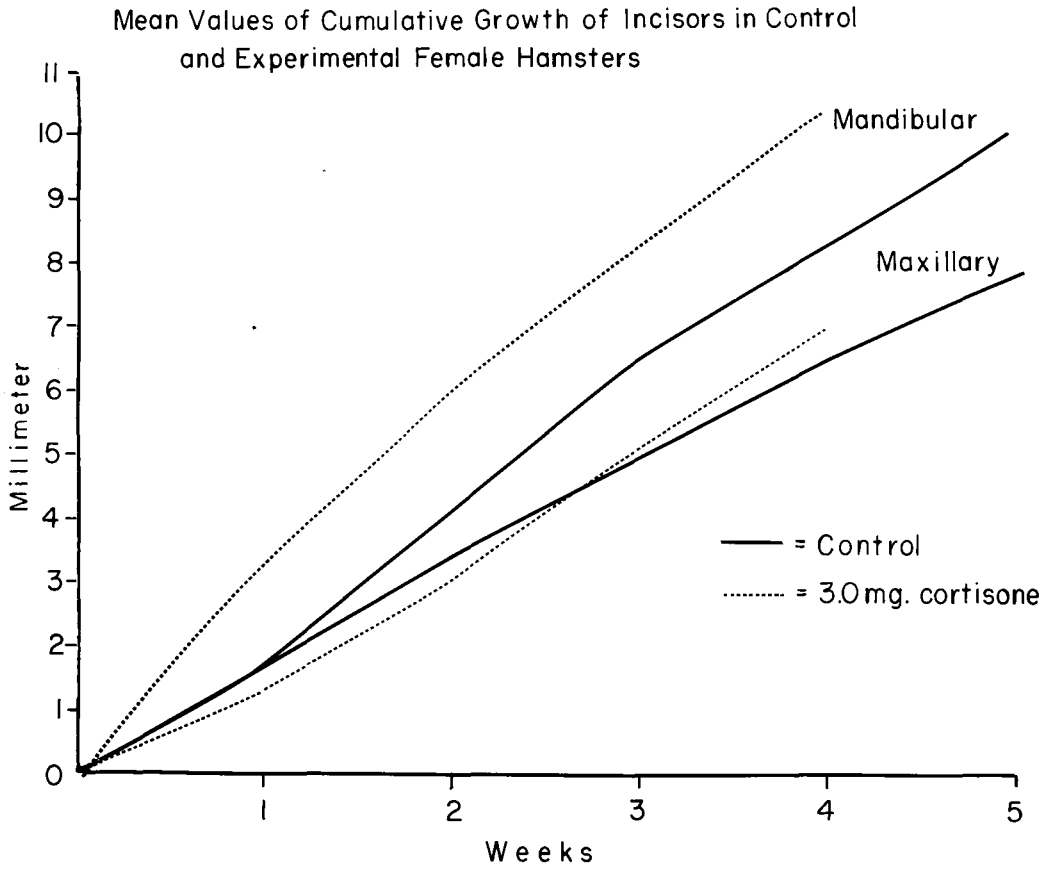

Mean Values of Cumulative Growth of Incisors in Control and Experimental Female Hamsters
Millimeter
0
1
2
3
4
5
6
7
8
9
10
11
Weeks
1
2
3
4
5
Mandibular
Maxillary
= Control
= 3.0 mg. cortisone

PLATE I

Figure 6 The extent of incisor development in a normal hamster fetus, 11 days and 15.5 hours after conception. (parasaggital section)

Magnification: x 67

Key:
M.I. - Maxillary Incisor
D.C. - Dental Cup
L. - Lip
P.M. - Pulp Mesenchyme
T. - Tongue
M's C. - Meckel's Cartilage

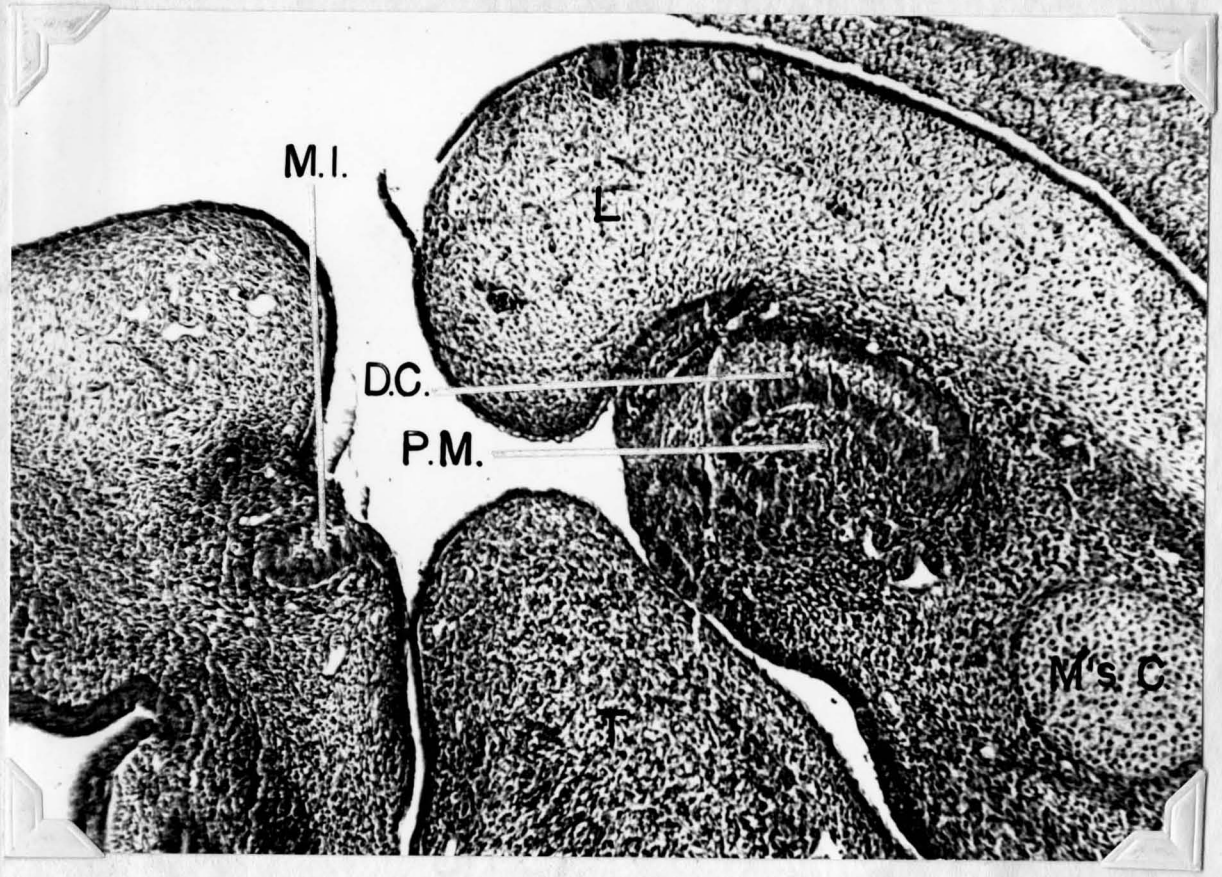


FIGURE 6

PLATE II

Figure 7 The extent of incisor development in a normal hamster fetus, 12 days and 20 hours after conception. (parasaggital section)

Magnification: x 40

Key:

M.I.	- Maxillary Incisor
L.	- Lip
T.	- Tongue
M's. C.	- Meckel's Cargilage
A.	- Ameloblast layer
O.	- Odontoblast layer
P.	- Pulp
N.C.	- Nasal Cavity

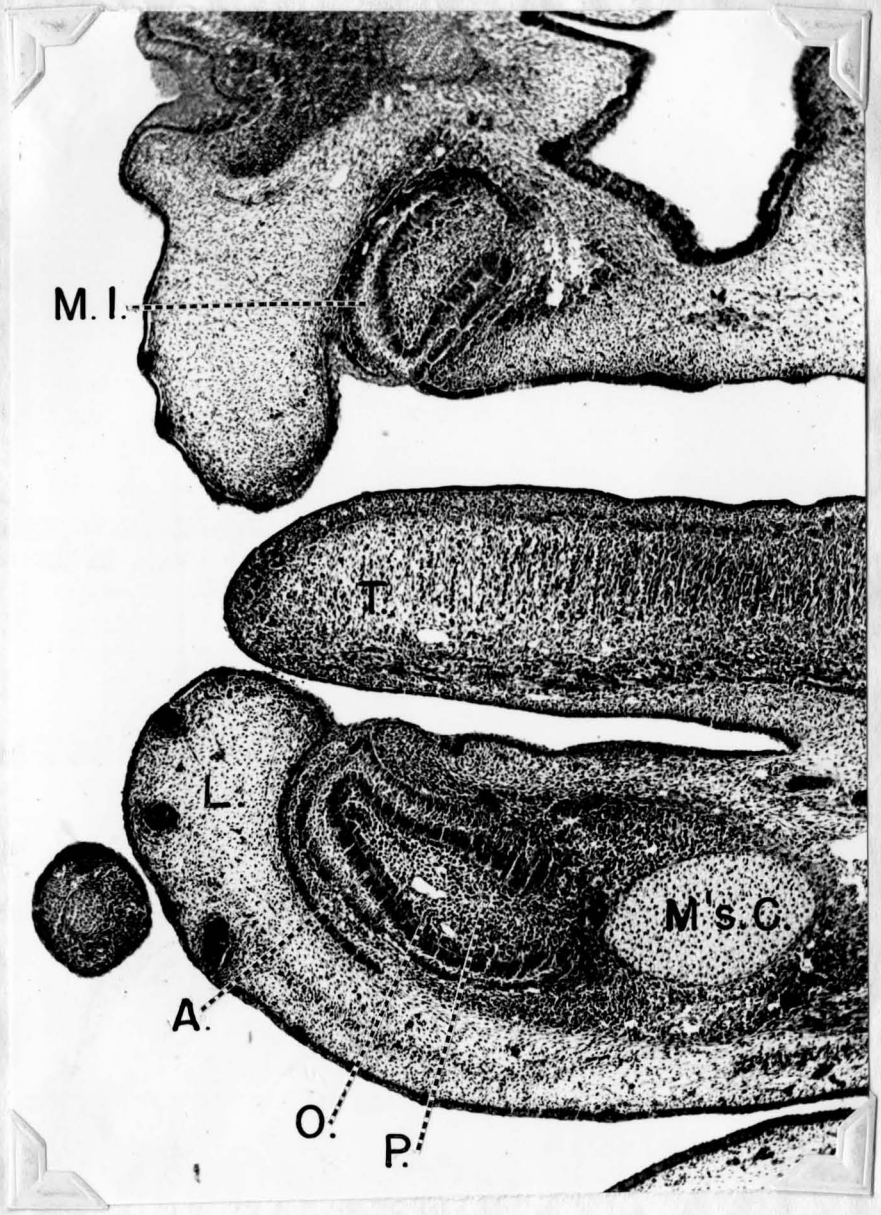


FIGURE 7

PLATE III

Figure 8 The extent of incisor development in a normal hamster fetus, 13 days and 20 hours after conception. (parasaggital section)

Magnification: x 25

Key:

P.	- Palate
M.I.	- Maxillary Incisor
T.	- Tongue
$M.I._2$	- Mandibular Incisor
O.	- Odontoblast layer
A.	- Ameloblast layer
P.	- Pulp
B. of M.	- Bone of Mandible

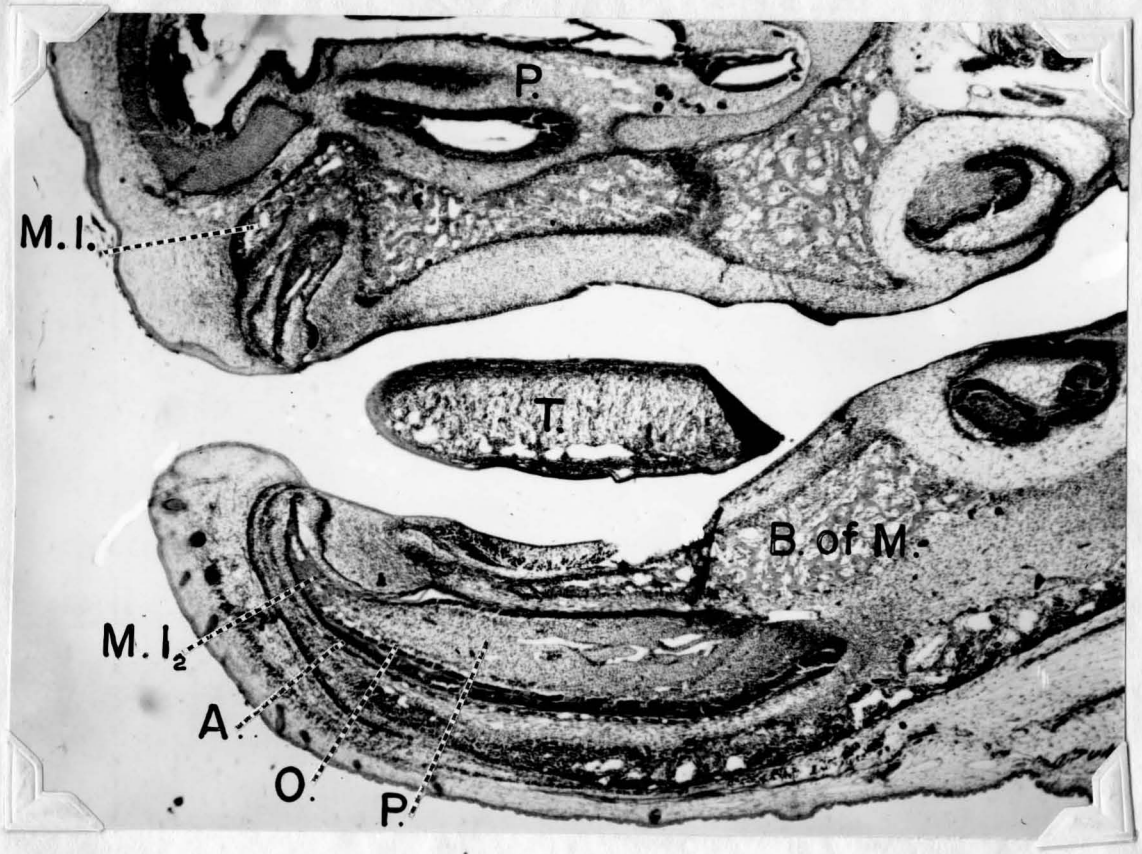


FIGURE 8

PLATE IV

Figure 9 The extent of incisor development in a normal hamster fetus, 14 days and 14 hours after conception. (parasaggital section)

Magnification: x 25

Key:

M.I. - Maxillary Incisor
O.E. - Oral Epithelium
T. - Tongue
M.I.T. - Mandibular Incisor Tip
M. - Mandible

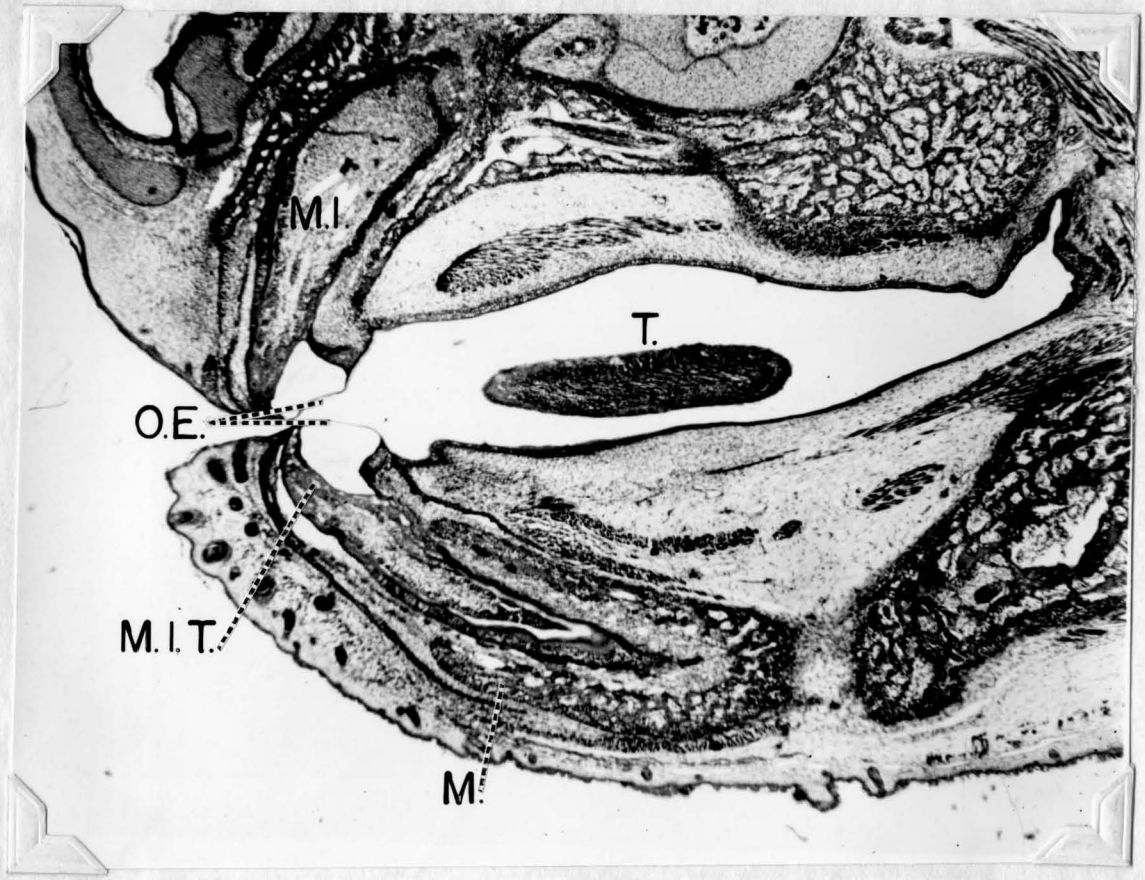


FIGURE 9

PLATE V

Figure 10 The extent of incisor development at the time of birth in the normal hamster. (parasaggital section)

Magnification: x 21

Key:

M.I.	- Maxillary Incisor
G.M.	- Gingival Margin
O.	- Odontoblast layer
A.	- Ameloblast layer
M.	- Mandible
P.	- Pulp
T.	- Tongue

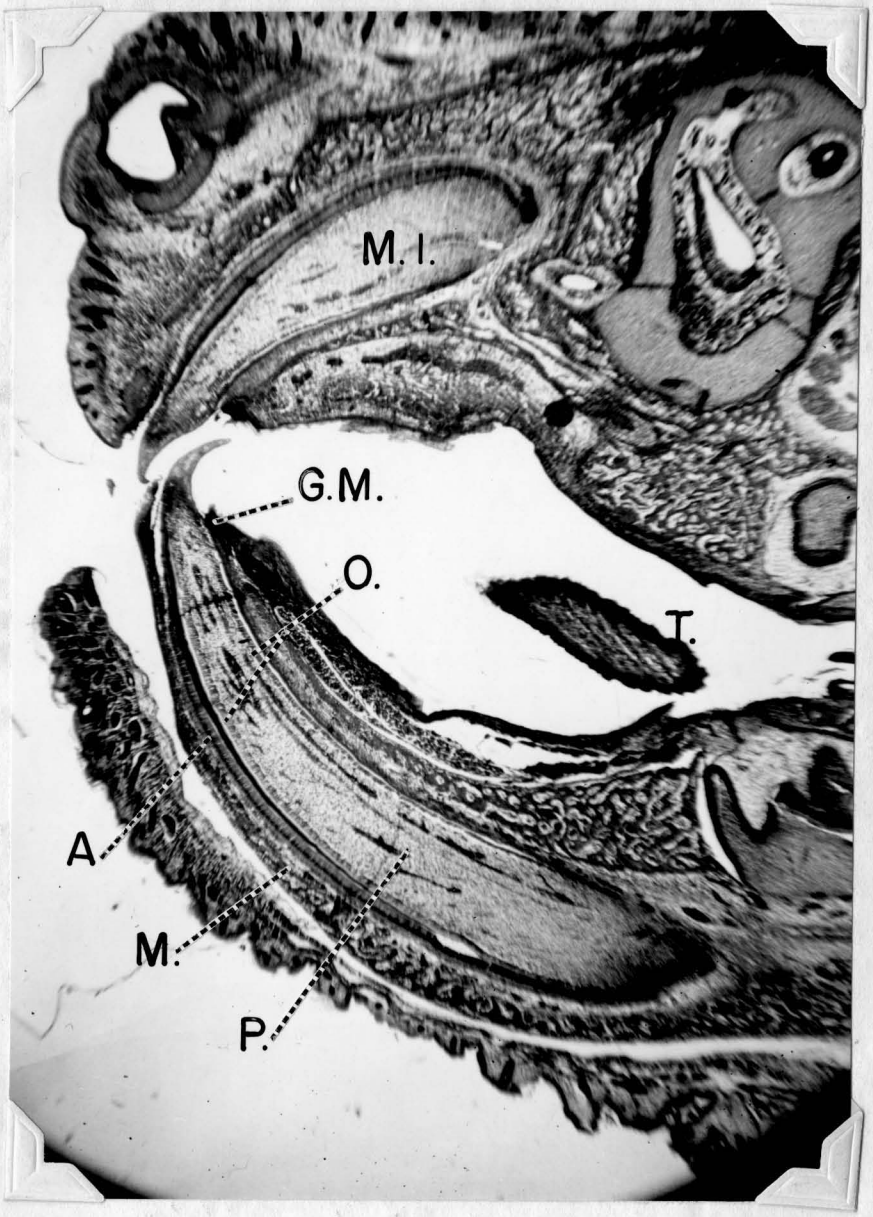


FIGURE 10

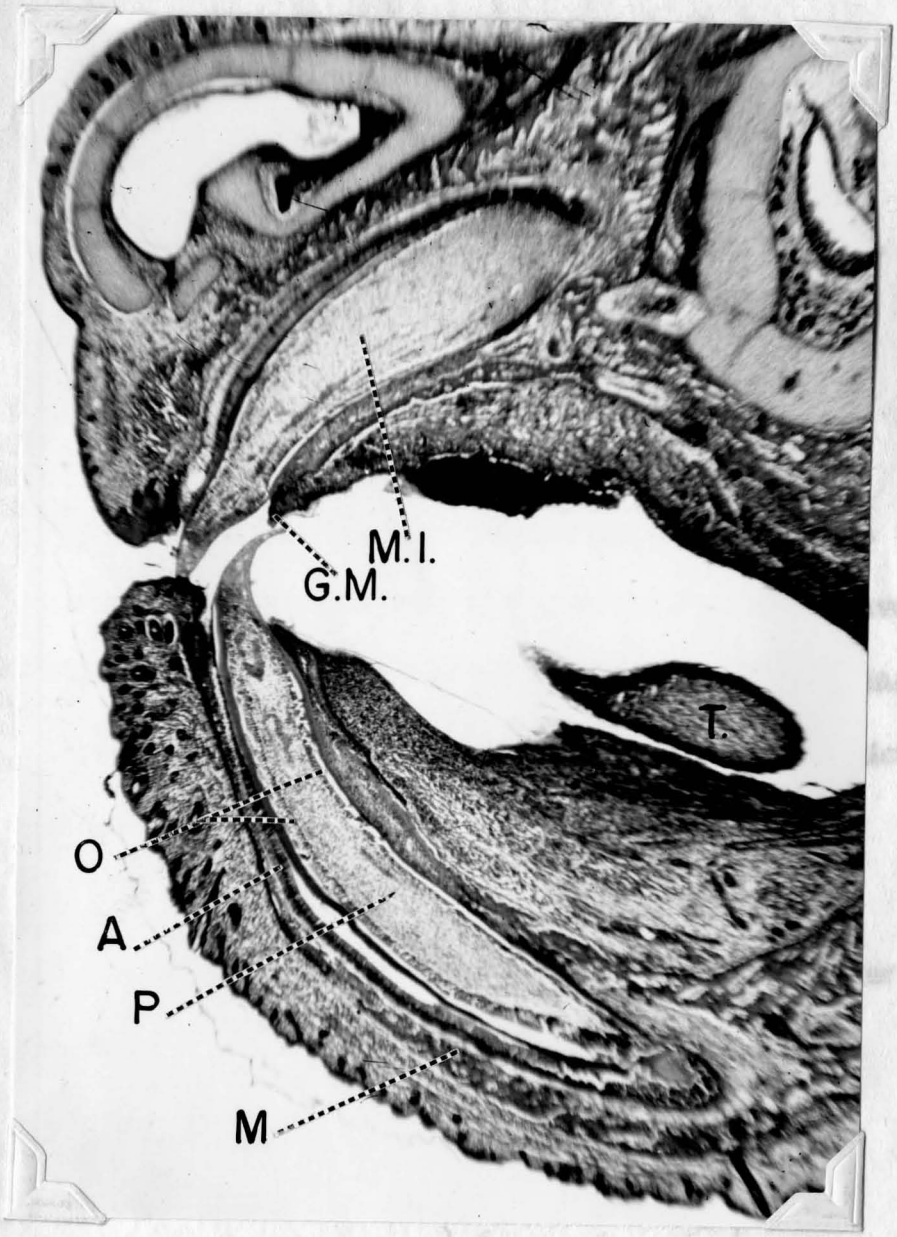
PLATE VI

Figure 11 The extent of incisor development at the time of birth in a hamster whose mother had received one daily injection of 3.0 mg. of cortisone for four successive days prior to parturition. (parasaggital section)

Magnification: x 21

Key:

M.I.	-	Maxillary Incisor
G.M.	-	Gingival Margin
O.	-	Ondontoblast layer
A.	-	Ameloblast layer
P.	-	Pulp
M.	-	Mandible
T.	-	Tongue



June 3, 1957
Date

Signature of Advisor

FIGURE 11

APPROVAL SHEET

The thesis submitted by Sigurd Carl Sandzen, Jr. has been read and approved by three members of the Department of Anatomy.

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated, and that the thesis is now given final approval with reference to content, form, and mechanical accuracy.

The thesis is therefore accepted in partial fulfillment of the requirements for the Degree of Master of Science.

June 3, 1959
Date

Lincoln E. Young
Signature of Adviser